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April 12, 2006

Ms. Joan Fleck
North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Subject: **Monitoring Well Reconstruction and Limited Excavation Workplan
Addendum**
Rotten Robbie Service Station No. 40
2515 Guerneville Road, Santa Rosa, Sonoma County, California
Apex Project No. ROB01.001

Dear Ms. Fleck:

Apex Envirotech, Inc. (Apex), has been authorized by Robinson Oil Corporation (Robinson Oil) to provide this workplan addendum proposing the destruction of three groundwater monitoring wells, reconstruction of one monitoring well and limited excavation of petroleum hydrocarbon impacted soil at the subject site (Figures 1 and 2). This workplan addendum was required by the City of Santa Rosa Fire Department (SRFD), as noted on the Hazardous Materials Plan Review included as Appendix A. All work proposed herein will be conducted according to Apex standard operating procedures (Appendix B).

This report is based in part on information obtained from Robinson Oil and is subject to modification as newly acquired information warrants.

BACKGROUND

November 1991 - On-Site Technologies, Inc. (OST) prepared a Remedial Investigation/Feasibility Study report recommending soil and groundwater remediation through groundwater extraction treatment.

December 15, 1995 - OST recommended a soil vapor extraction (SVE) and air sparge (AS) system be coupled with the groundwater extraction treatment as a more beneficial and cost effective remedial technology.

June 26, 1996 - OST proposed annual groundwater monitoring be conducted at the subject site, and groundwater extraction and treatment be supplemented with SVE/AS.

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January 29, 1998 - The North Coast Regional Water Quality Control Board (NCRWQCB) issued a letter, requesting a feasibility study be prepared proposing alternative remediation technologies.

April 20, 1999 - ATC Associates, Inc. submitted a *Remedial Action/Feasibility Study and Corrective Action Plan*, proposing active dual phase extraction.

April 20, 2003 - Based on groundwater contamination at the subject site, the NCRWQCB proposed deferring implementation of a remediation system and continue groundwater monitoring activities

July 24, 2004 - Apex submitted *Workplan for Installation of Ozone Sparging Remediation System*, proposing the installation of an ozone sparge system at the subject site, and other remedial alternatives.

December 3, 2004 - The NCRWQCB issued a letter recommending that the ozone sparge remediation system be permitted through the Santa Rosa Fire and Community Development Department. In addition, the NCRWQCB requested that well MW-11 from the Former Crossroads Beacon site be included in Apex's quarterly sampling schedule. The approved remediation system at the site will be installed concurrently with pending site demolition and reconstruction.

GROUNDWATER MONITORING WELL DESTRUCTIONS/RECONSTRUCTION

Due to the planned demolition of the site and subsequent reconstruction of a new convenience store, Apex has destroyed groundwater monitoring wells MW-2, MW- 5 and MW-6 (Figure 2), as approved by the NCRWQCB. All three monitoring wells were completely overdrilled to total depth and grouted to surface, using a tremmie pipe, with Portland cement.

Monitoring well MW-5 will be relocated, outside of the new building footprint, at the location shown on Figure 3. The new well (MW-5A) will be constructed identically to well MW-5 (Table 1).

PROPOSED LIMITED EXCAVATION

Excavation

With the exception of the existing underground storage tanks, the entire fueling system will be replaced as part of the site renovation work. Therefore, Apex proposes that a limited excavation be conducted in the current dispenser island area, as shown on Figure 4. The excavation will extend to the extent feasible, which will be just above the depth-to-groundwater measured the day of the excavation. The depth-to-groundwater measurement will be collected from monitoring well MW-1. Current depth-to-groundwater is approximately 5.5-feet below ground

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surface. Excavated soil will be temporarily stockpiled onsite between layers of visqueen, pending disposal.

Five confirmation soil samples will be collected from the base of the excavation at the locations shown on Figure 4. The soil samples will be collected according to EPA Method 5035, using EnCore® sample containers. The soil samples will be transported under chain of custody documentation to a State-certified analytical laboratory for analysis of:

Analysis	Abbreviation	Designation	USEPA Method No.
Total Petroleum Hydrocarbons as Diesel	TPHd	Gas-Range Hydrocarbons	8015M
Total Petroleum Hydrocarbons as Gasoline	TPHg		
Benzene	BTEX	Aromatic Volatile Organics	8260B
Toluene			
Ethylbenzene			
Xylenes (Total)			
MethylTertiary Butyl Ether	MTBE	Five Fuel Oxygenates	
Di-Isopropyl Ether	DIPE		
Ethyl Tertiary Butyl Ether	ETBE		
Tertiay Amyl Methyl Ether	TAME		
Tertiary Butal Alcohol	TBA		
1,2-Dichloroethane	1,2-DCA	Lead	

A 4:1 composite sample will be collected from the soil stockpile and analyzed for the constituents listed in the table above and for total lead by EPA Method 6010. Once the laboratory analytical results are received, disposal options will be considered.

Backfill

Once the excavation is complete and all soil samples have been collected, the excavation will be backfilled with clean, imported fill and compacted to the specifications required by the City of Santa Rosa Building Department.

ATTACHMENTS:

Figure 1: Site Vicinity Map
Figure 2: Site Plan Map
Figure 3: Proposed Monitoring Well Location Map
Figure 4: Proposed Excavation Area and Sample Locations

Table 1: Well Construction Details

Appendix A: SRFD Hazardous Materials Plan Review Form
Appendix B: Apex Standard Operating Procedures

REPORT DISTRIBUTION

A copy of this report was submitted to:

Regulatory Oversight:	Mr. Jeff Tarter City of Santa Rosa Fire Department 955 Sonoma Avenue Santa Rosa, California 95404 (707) 543-3500
	Ms. Joan Fleck North Coast Regional Water Quality Control Board 5550 Skylane Boulevard, Suite A Santa Rosa, California 95403 (707) 576-2220
Responsible Party:	Mr. Thomas L. Robinson
cc:	Mr. Brian Wingard Mr. Ron Michelson

REMARKS/SIGNATURES

The information contained within this workplan reflects our professional opinions and was developed in accordance with currently available information, and accepted hydrogeologic and engineering practices

The work described above will be performed under the direct supervision of the professional geologist, registered with the State of California, whose signature appears below

We appreciate the opportunity to provide Robinson Oil geologic, engineering and environmental consulting services, and trust this workplan meets your needs. If you have any questions or comments, please call us at (916) 851-0174

Sincerely,

APEX ENVIROTECH, INC.



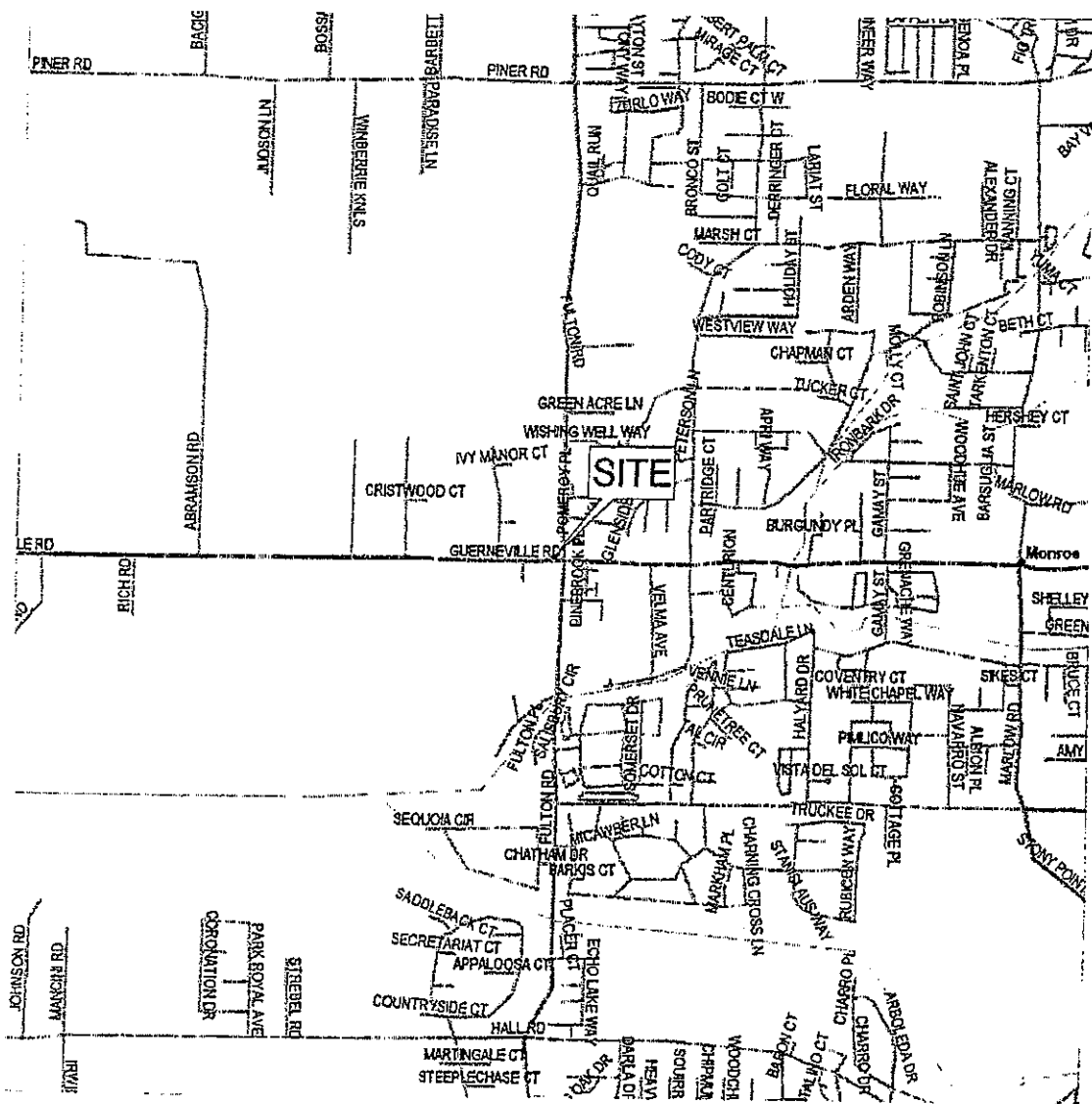
Kasey L. Jones
Senior Project Manager



Michael S Sgourakis R.G.
Senior Project Manager
CRG No 7194



FIGURES



0 2,000 4,000

Approximate Scale
1 inch = 2,000 feet



DRAWN BY: J Curry
DATE: 05/11/05

REVISIONS

SITE VICINITY MAP

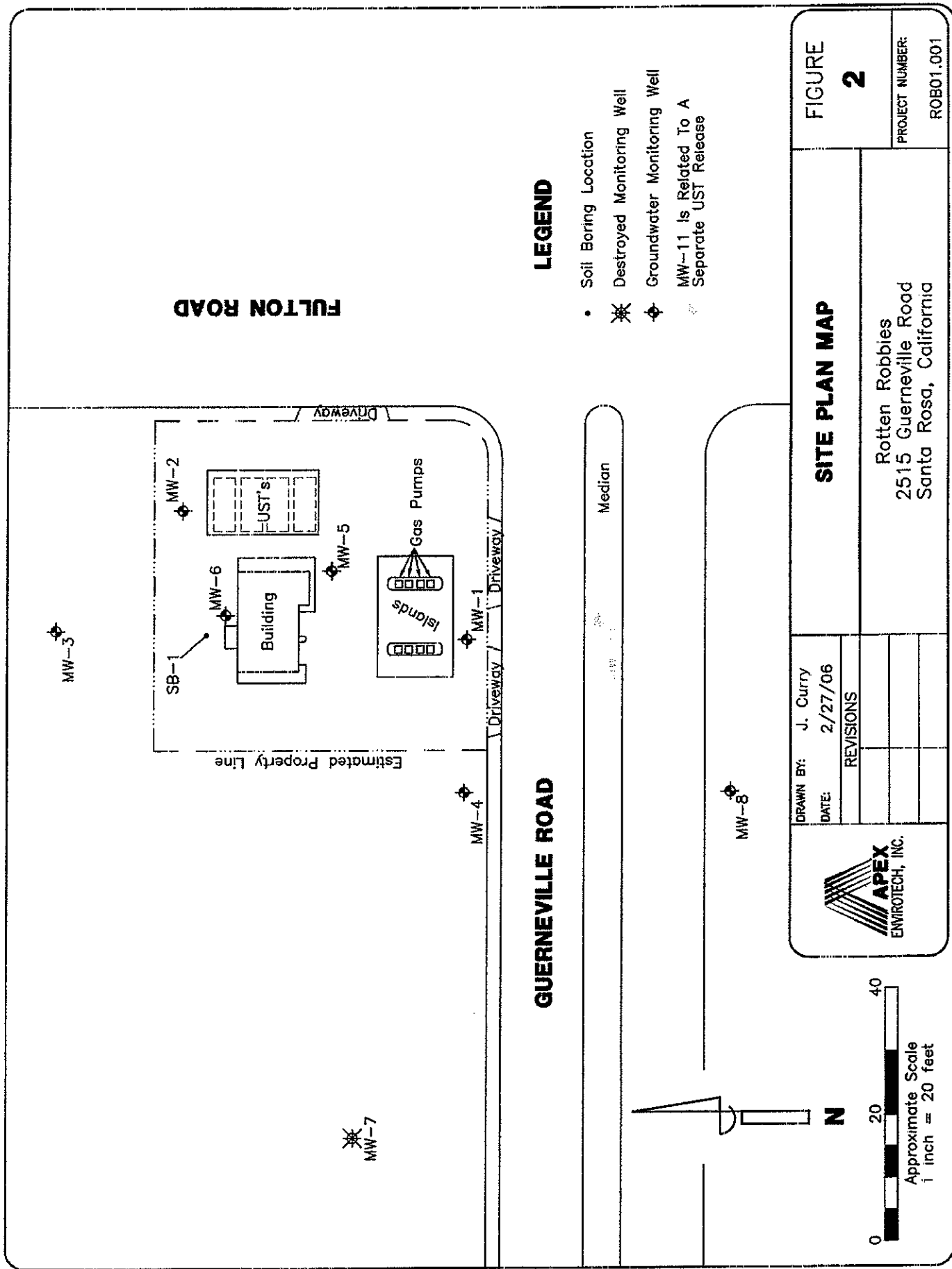
Rotten Robbies
2515 Guerneville Road
Santa Rosa, California

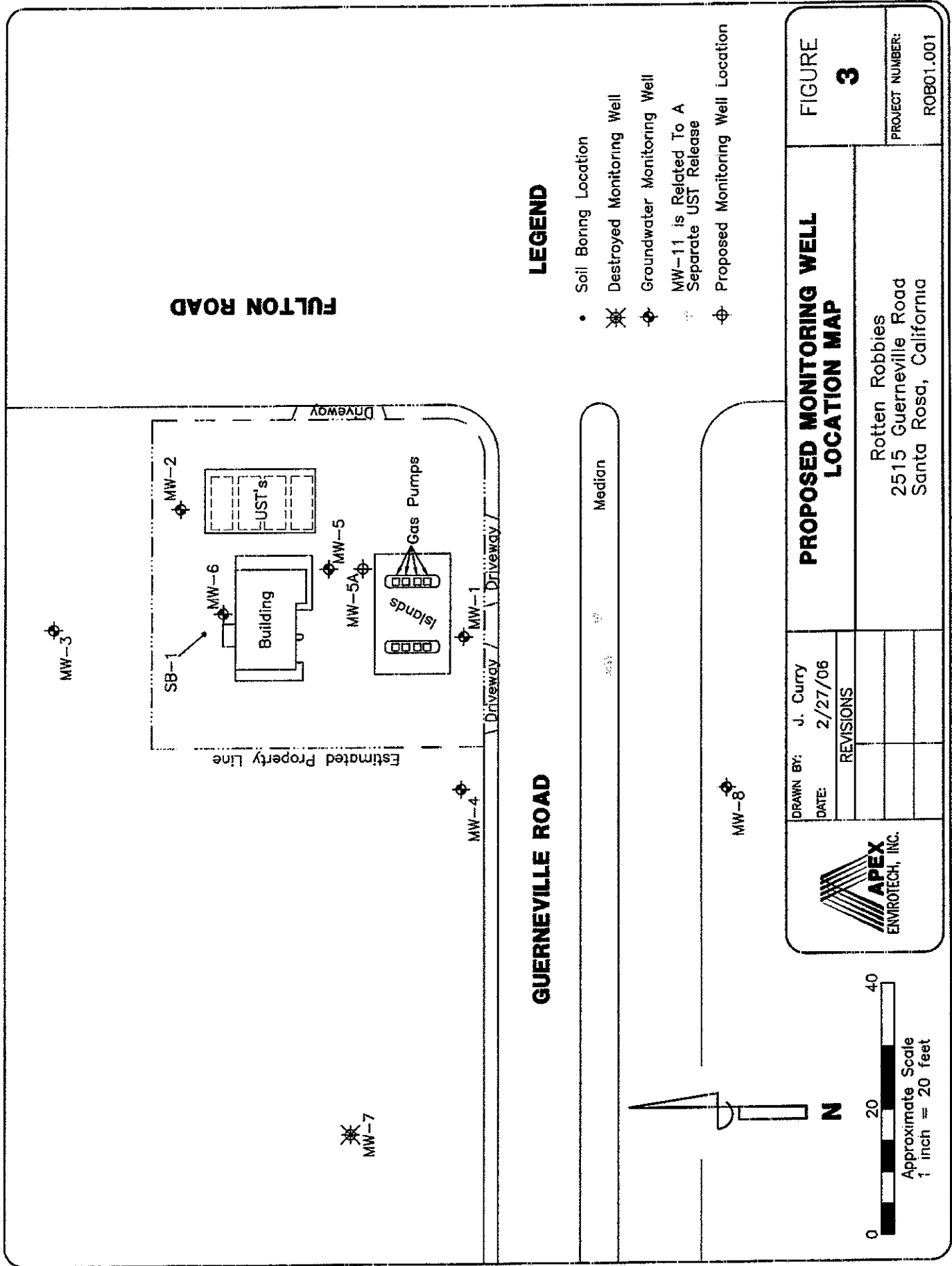
FIGURE

1

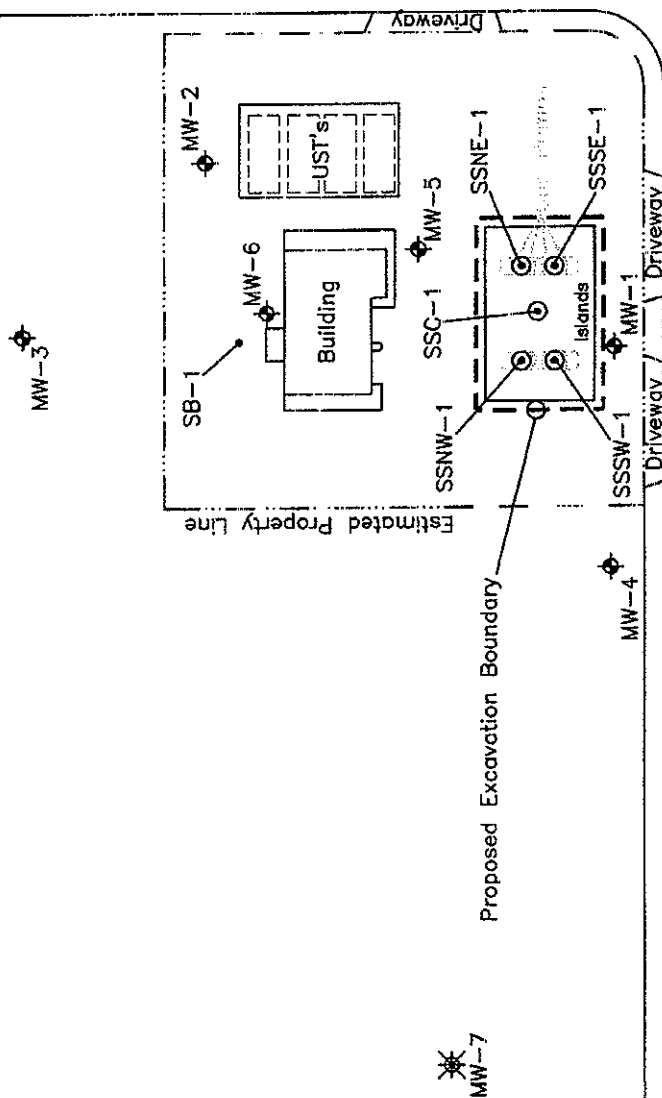
PROJECT NUMBER:

ROB01.001





FULTON ROAD



GUERNEVILLE ROAD

Median

LEGEND

- Soil Boring Location
- ✱ Destroyed Monitoring Well
- ⊕ Groundwater Monitoring Well
- ⊖ MW-11 Is Related To A Separate UST Release
- ⊙ Proposed Soil Sample Location
- Proposed Excavation Boundary

PROPOSED EXCAVATION AREA AND SAMPLE LOCATIONS

FIGURE

4

Rotten Robbins
2515 Guerneville Road
Santa Rosa, California

PROJECT NUMBER:

ROB01.001

DRAWN BY: J. Curry

DATE: 2/27/06

REVISIONS



TABLE

TABLE 1
WELL CONSTRUCTION DETAILS
 Rotten Robbie Service Station No 40
 2515 Guerneville Road, Santa Rosa, California

Well Number	Well Installation Date	Elevation TOC (feet)	Casing Material	Total Depth (feet)	Well Depth (feet)	Casing Diameter (inches)	Screened Interval (feet)	Filter Pack Interval (feet)
MW-1	10/25/89	95.37	PVC	30	30	4	8 - 30	6 - 30
MW-2	10/25/89	95.81	PVC	20	20	4	7 - 20	5 - 20
MW-3	10/26/89	94.50	PVC	20	20	4	7 - 20	5 - 20
MW-4	6/12/90	94.50	PVC	18.3	18.3	4	6 - 18.2	5 - 18.2
MW-5	6/12/90	96.44	PVC	18.3	18.3	4	6 - 18.2	5 - 18.2
MW-6	6/12/90	96.69	PVC	18.3	18.3	4	6 - 18.2	5 - 18.2
MW-8	5/24/91	95.53	PVC	19	19	4	7 - 19	5 - 19
MW-11		96.28	PVC					

Notes:

--- = Information not available

TOC = Top of Casing

MW-11 is the responsibility of a separate consultant

APPENDIX A

SRFD HAZARDOUS MATERIALS PLAN REVIEW FORM



955 Sonoma Avenue
 Santa Rosa, CA 95404
 Phone: (707) 543-3500
 Fax: (707) 543-3520
 www.SantaRosaFD.com

**HAZARDOUS MATERIALS PLAN REVIEW
 A CERTIFIED UNIFIED PROGRAM AGENCY
 C.U.P.A.**

Project: Rotten Robbie #40
 Address: 2515 Guerneville Rd
 Type of Review: Soil Remediation
 Permit Number: F06-0189
 Review Number: 1
 Contact: ddahme@ci.santa-rosa.ca.us

Date: 4/07/06

RETURN TO:

**Robinson Oil Corp.
 4250 Williams Rd.
 San Jose, CA 95129**


THIS PERMIT HAS BEEN REVIEWED AND DETERMINED TO BE:

- ☐ **APPROVED**
- ☐ **APPROVED WITH CONDITIONS**
- ☒ **NOT APPROVED** (A complete plan check could not be completed. Please revise per attached comments)

NOTE: Please review the comments and make corrections, changes and/or additions as required. Approval of this plan does not approve any omission or deviation from the applicable regulations. Final approval is subject to field inspection. Approved plans shall be on site and available for review at all times.

Item #	Required	Comments	Correction
1	X	Applicant must submit verification of workers compensation prior to approval of permit.	
2	X	Remediation/clean up requirements in the City of Santa Rosa are to non-detect, background levels, or to extent feasible. Excavation limits for all areas will be as directed by the on site Santa Rosa Fire Inspector, based on analytical results. Please revise excavation plan to include requirement.	
3	X	In addition to the listed analytical the following must be performed for all samples: TPHd. If there were former waste oil UST's, the samples must also be analyzed for TPHmo, VOC's and LUFT 5 Please revise plan.	
4	X	EPA 5035 or EnCore samples are required in accordance with the North Coast Regional Water Quality Control Board. Please revise sampling plan.	

5	X	Backfill requirements must be as per the City of Santa Rosa Building Department. Please revise backfill plan	
6		Sample locations may be modified in the field as directed by the SRFD and/or the RWQCB; but at a minimum will consist of bottom samples, sidewall samples, stock-pile composite samples. During UST piping removal, product piping samples are required under each dispenser, ever 20 linier feet of pipe and at each union.	
7		During site excavation, if further evidence of soil contamination is discovered, visually or by sample results, then further excavation will be required Will verify on site.	
8		During excavation, if the integrity of either the public way or existing UST's are in question, shoring will be required.	
9		Provide site security with fencing, barricades, or security-type personnel during soil remediation operations. Will verify on site.	
10		All work must be conducted in compliance with RWQCB approval.	
11		UST system installation will not be allowed until completion of soil remediation as determined by SRFD and RWQCB.	
12		A copy of all reports must be submitted to the SRFD and RWQCB, including: a final soil sampling/remediation report that contains, in part, analytical data, site plan and manifests for soil.	
13		Contact the Fire Department at (707) 543-3500 a minimum of 48 hours in advance to schedule an inspection.	
14		The Fire Department Inspector must give authorization or approval, prior to backfill Backfill will be based upon sample analytical results as they relate to SRFD cleanup objectives.	
15		The Santa Rosa Fire Department reserves the right to require additional excavation and samples if it is determined the contamination exists beyond the area proposed in this clean up.	


Inspector (signature)

4-7-06
Date

APPENDIX B

APEX STANDARD OPERATING PROCEDURES

APEX ENVIROTECH, INC.

STANDARD OPERATING PROCEDURES

SOP-1 SOIL BORING SAMPLING

During drilling, soil samples for chemical analysis are collected in thin-walled brass tubes, of varying diameters and lengths (e.g., 4 or 6 inches long by 2 inches outside diameter). Three or four of the selected tubes plus a spacer tube, are set in an 18-inch long split-barrel sampler of the appropriate inside-diameter.

Where possible, the split-barrel sampler is driven its entire length either hydraulically or using a 140-pound drop hammer. The sampler is extracted from the borehole and the brass tubes, containing the soil samples, are removed. Upon removal from the sampler, the selected brass tubes are either immediately trimmed and capped with aluminum foil or "Teflon" sheets and plastic caps or the samples are extruded from the tubes and sealed within other appropriate, cleaned sample containers. The samples are then hermetically sealed, labeled, and refrigerated for delivery, under strict chain-of-custody, to the analytical laboratory. These procedures minimize the potential for cross-contamination and volatilization of volatile organic compounds (VOC) prior to chemical analysis.

One soil sample collected at each sampling interval is analyzed in the field using either a portable photoionization detector (PID), flame ionization detector, organic vapor analyzer, catalytic gas detector, or an explosimeter. The purpose of this field analysis is to qualitatively determine the presence or absence of hydrocarbons, and the samples to be analyzed at the laboratory. The soil sample is sealed in either a brass tube, glass jar, or plastic bag to allow for some volatilization of VOC. The PID is then used to measure the concentrations of hydrocarbons within the containers' headspace. The data is recorded on both field notes and the boring logs at the depth corresponding to the sampling point.

Other soil samples are collected to document the soil and/or stratigraphic profile beneath the project site, and estimate the relative permeability of the subsurface materials. All drilling and sampling equipment are either steam cleaned or washed in solution and doubly rinsed in deionized water prior to use at each site and between boreholes to minimize the potential for cross-contamination.

In the event the soil samples cannot be submitted to the analytical laboratory on the same day they are collected (e.g., due to weekends or holidays), the samples are temporarily stored until the first opportunity for submittal either on ice in a cooler, such as when in the field, or in a refrigerator at Apex's office.

SOP-2 SOIL EXCAVATION AND SAMPLING

Excavation and subsequent soil sampling is performed under the direction of a registered geologist or civil engineer. To reduce the potential for cross-contamination, all excavation equipment is either steam cleaned or washed prior to use and between excavations. Soil samples for chemical analysis are collected in cleaned, thin-walled brass tubes of varying diameters and lengths (e.g., 6 inches long by 2 inches outside diameter) or other appropriate cleaned sample container. If used, one tube may be set in a 2-inch inside diameter, hand-driven sampler. To reduce the potential for cross-contamination between samples, the sampler is washed in a solution and doubly rinsed between each sampling event.

Upon recovery, a portion of the soil sample is sealed for later screening with either a portable photoionization detector, flame ionization detector, or an explosimeter. Another portion of the sample is used for description of the excavated materials. A third portion of the sample is hermetically sealed, labeled and refrigerated for delivery, under strict chain-of-custody, to the analytical laboratory. These procedures minimize the potential for cross-contamination and volatilization of

volatile organic compounds prior to chemical analysis.

In the event the soil samples cannot be submitted to the analytical laboratory on the same day they are collected (e.g., due to weekends or holidays), the samples are temporarily stored until the first opportunity for submittal either on ice in a cooler, such as when in the field, or in a refrigerator at Apex's office.

SOP-3 SOIL CLASSIFICATION

Soil samples are classified according to the Unified Soil Classification System. Representative portions of the samples may be submitted, under strict chain-of-custody, to an analytical laboratory for further examination and verification of the in-field classification and analysis of soil mechanical and/or petrophysical properties. The soil types are indicated on logs of either excavations or borings together with depths corresponding to the sampling points and other pertinent information.

SOP-4 SAMPLE IDENTIFICATION AND CHAIN-OF-CUSTODY PROCEDURES

Sample identification and chain-of-custody procedures ensure sample integrity as well as document sample possession from the time of collection to ultimate disposal. Each sample container submitted for analysis is labeled to identify the job number, date, time of sample collection, a sample number unique to the sample, any in-field measurements made, sampling methodology, name(s) of on-site personnel, and any other pertinent field observations also recorded on the field excavation or boring log.

Chain-of-custody forms are used to record possession of the sample from time of collection to arrival at the laboratory. During shipment, the person with custody of the samples will relinquish them to the next person by signing the chain-of-custody form(s) and noting the date and time. The sample-control officer at the laboratory will verify sample integrity, correct preservation, confirm collection in the proper container(s), and ensure adequate volume for analysis.

If these conditions are met, the samples will be assigned unique laboratory log numbers for identification throughout analysis and reporting. The log numbers will be recorded on the chain-of-custody forms and in the legally-required log book maintained in the laboratory. The sample description, date received, client's name, and any other relevant information will also be recorded.

SOP-5 LABORATORY ANALYTICAL QUALITY ASSURANCE AND CONTROL

In addition to routine instrument calibration, replicates, spikes, blanks, spiked blanks, and certified reference materials are routinely analyzed at method-specific frequencies to monitor precision and bias. Additional components of the laboratory Quality Assurance/Quality Control program include:

1. Participation in state and federal laboratory accreditation/certification programs;
2. Participation in both U.S. EPA Performance Evaluation studies (WS and WP studies) and inter-laboratory performance evaluation programs;
3. Standard operating procedures describing routine and periodic instrument maintenance;

- 4 "Out-of-Control"/Corrective Action documentation procedures; and
- 5 Multi-level review of raw data and client reports

SOP-6

HOLLOW-STEM AUGER MONITORING WELL INSTALLATION AND DEVELOPMENT

Boreholes for monitoring wells are drilled using a truck-mounted, hollow-stem auger drill rig. The borehole diameter will be a minimum of 4 inches larger than the outside diameter of the casing when installing well screen. The hollow-stem auger provides minimal interruption of drilling while permitting soil sampling at desired intervals. Soil samples are collected by either hammering (with a 140-pound drop hammer) or hydraulically pushing a conventional split-barrel sampler containing pre-cleaned 2-inch-diameter brass tubes. A geologist or engineer from Apex Envirotech, Inc., continuously logs each borehole during drilling and constantly checks drill cuttings for indications of both the first recognizable occurrence of groundwater and volatile hydrocarbons using either a portable photoionization detector, flame ionization detector, or an explosimeter. The sampler is rinsed between samples and either steam cleaned or washed with all other drilling equipment between borings to minimize the potential for cross-contamination.

Monitoring wells are cased with threaded, factory-perforated and blank Schedule 40 PVC. The perforated interval consists of slotted casing, generally with 0.020-inch wide by 1.5-inch long slots, with 42 slots per foot. A PVC cap may be secured to the bottom of the casing with stainless steel screws; no solvents or cements are used. Centering devices may be fastened to the casing to ensure even distribution of filter material and grout within the borehole annulus. The well casing is thoroughly washed and/or steam cleaned, or may be purchased as pre-cleaned, prior to installation.

After setting the casing inside the hollow-stem auger, sand or gravel filter material is poured into the annular space to fill from boring bottom to generally 1 foot above the perforated interval. A 1- to 2-foot thick bentonite plug is set above this filter material to prevent grout from infiltrating the filter pack. Either neat cement, containing about 5 percent bentonite, or sand-cement grout is then tamped into the annular space from the top of the bentonite plug to near surface. A traffic-rated vault is installed around each wellhead for wells located in parking lots or driveways, while steel "stovepipes" are usually set over wellheads in landscaped areas.

After installation, the wells are thoroughly developed to remove residual drilling materials from the wellbore, and to improve well performance by removing fine material from the filter pack that may pass into the well. Well development techniques used may include pumping, surging, bailing, swabbing, jetting, flushing, and air-lifting. All development water is collected either in drums or tanks for temporary storage, and properly disposed of depending on laboratory analytical results. To minimize the potential for cross-contamination between wells, all development equipment is either steam cleaned or properly washed prior to use. Following development, the well is allowed to stand undisturbed for a minimum of 24 hours before its first sampling.

SOP-7

GROUNDWATER PURGING AND SAMPLING

Prior to water sampling, each well is purged by evacuating a minimum of three wetted well-casing volumes of groundwater. When required, purging will continue until either the discharge water temperature, conductivity, or pH stabilize, a maximum of ten wetted-casing volumes of groundwater have been recovered, or the well is bailed dry. When practical, the groundwater sample should be collected when the water level in the well recovers to at least 80 percent of its static level.

The sampling equipment consists of either a "Teflon" bailer, PVC

bailer, or stainless steel bladder pump with a "Teflon" bladder. If the sampling system is dedicated to the well, then the bailer is usually "Teflon," but the bladder pump is PVC with a polypropylene bladder. In general and depending on the intended laboratory analysis, 40-milliliter glass, volatile organic analysis (VOA) vials, with "Teflon" septa, are used as sample containers.

The groundwater sample is decanted into each VOA vial in such a manner that there is no meniscus at the top of the vial. A cap is quickly secured to the top of the vial. The vial is then inverted and gently tapped to see if air bubbles are present. If none are present, the vial is labeled and refrigerated for delivery, under strict chain-of-custody, to the analytical laboratory. Label information should include a unique sample identification number, job identification number, date, time, type of analysis requested, and the sampler's name.

For quality control purposes, a duplicate water sample is collected from each well. This sample may also be analyzed or put on hold at the laboratory. When required, a trip blank, prepared at the laboratory, is placed in the transport cooler. It is labeled similar to the well samples, remains in the cooler during transport, and is analyzed by the laboratory along with the groundwater samples. In addition, a field blank may be prepared in the field when sampling equipment is not dedicated. The field blank is prepared after a pump or bailer has been either steam cleaned or properly washed, prior to use in the next well, and is analyzed along with the other samples. The field blank analysis demonstrates the effectiveness of the in-field cleaning procedures to prevent cross-contamination.

To minimize the potential for cross-contamination between wells, all well development and water sampling equipment not dedicated to a well is either steam cleaned or properly washed between use. As a secondary precautionary measure, wells are sampled in order of least to highest concentrations as established by available previous analytical data.

In the event the water samples cannot be submitted to the analytical laboratory on the same day they are collected (e.g., due to weekends or holidays), the samples are temporarily stored until the first opportunity for submittal either on water ice in a cooler, such as when in the field, or in refrigerator at Apex's office.

SOP-8

ROTARY DRILLING MONITORING WELL INSTALLATION AND DEVELOPMENT

Boreholes for monitoring wells may be drilled using truck-mounted drill rigs capable of air- and mud-rotary drilling, and continuous coring and/or drilling with tri-cone roller or fixed-blade drag bits. Generally, rotary drilling is used when more conventional hollow-stem auger drilling either is or becomes infeasible. Various drilling fluids (mud or air), used to keep the borehole from caving and to remove drill cuttings, are chosen according to the nature of the soils and/or geologic formations expected to be encountered as well as the monitoring program. Samples may be collected directly from cores. A geologist or engineer from Apex Envirotech, Inc., continuously logs each boring during drilling and checks returned drill cuttings for indications of both the first recognizable occurrence of groundwater and volatile hydrocarbons, using either a portable photoionization detector (PID), flame ionization detector, or explosimeter. All drilling equipment is either steam cleaned or washed between borings to minimize the potential for cross-contamination.

Frequently, hollow-stem augers are used to drill and sample to either a minimum depth or auger refusal. In such cases, the augers may be left in place as temporary surface casing, with the center plug removed and drilling/coring carried out through the augers. Alternatively, a shallow conductor casing, or surface casing, may be set by drilling to a desired depth with a large-diameter bit, then setting the casing and proceeding with the drilling/coring. After total drill depth (TD) is reached, the borehole may be logged by geophysical means or hydraulically tested. If casing is not set to the

bottom of the borehole, the lower portion of the hole may be grouted or backfilled accordingly. The borehole may be drilled out (reamed) Upon reaching TD, drilling fluid is circulated to remove cuttings. Selected casing is then run into the borehole and set to the desired depth. Monitoring wells are cased with clean, threaded, factory-perforated and blank casing. The perforated interval consists of slotted casing, generally with 0.020-inch-wide by 1.5-inch-long slots, with 42 slots per foot. Centering devices may be fastened to the casing to ensure even distribution of filter material and grout within the borehole annulus. The well casing is thoroughly washed and/or steam cleaned, or may be purchased as pre-cleaned, prior to installation. All recoverable drilling fluid and/or cuttings are collected for temporary storage and disposed of properly pending analytical results.

After setting the casing, sand or gravel filter material is poured into the annular space to fill from boring bottom to generally 1 foot above the perforated interval. A 1- to 2-foot-thick bentonite plug is set above this filter material to prevent grout from infiltrating the filter pack. Either neat cement, containing about 5 percent bentonite, or sand-cement grout is then tremied into the annular space from the top of the bentonite plug to near surface. A traffic-rated vault is installed around each wellhead for wells located in parking lots or driveways, while steel "stovepipes" are usually set over wellheads in landscaped areas.

After installation, the wells are thoroughly developed to remove residual drilling materials from the wellbore, and to improve well performance by removing fine material from the filter pack that may pass into the well. Well development techniques used may include pumping, surging, bailing, swabbing, jetting, flushing, and air-lifting. All development water is collected either in drums or tanks for temporary storage, and properly disposed of pending laboratory analytical results. To minimize the potential for cross-contamination between wells, all development equipment is either steam cleaned or properly washed prior to use. Following development, the well is allowed to stand undisturbed for a minimum of 24 hours before its first sampling.

SOP-9

VAPOR SAMPLING: "TEDLAR" BAG SAMPLING TECHNIQUE

Prior to vapor sampling, the vacuum system must reach a stabilized air flow (cubic feet per minute) for approximately 15 minutes. Prior to the actual collection of the vapor sample, the following data is recorded: air flow, temperature, and pressure at collection ports and gauges.

The sampling equipment consists of a "Tedlar" bag (available in 1, 3, 5, and 10 liter sizes), a diaphragm pump, and 1/4-inch-diameter polyethylene tubing (approximately 1 foot long).

The sampling ports are brass connections, fitted with a silicone septa, and threaded into a tapped hole in the system piping. The sampling procedure requires one end of the tubing be slipped over the sampling port and the other end over the diaphragm pump to acquire an air-tight connection. The sampling pump is purged for 1 minute with the extracted vapor to be sampled. Following purging, the discharge of the pump is then diverted through a two-way valve into the "Tedlar" bag, which should be filled to 3/4 of volume capacity. Caution should be taken not to overfill the sampling bag. The sample is placed in a non-refrigerated dry cooler with sufficient packing to eliminate damage during transport. Cooling samples will cause condensation of moisture within the sample, thereby distorting laboratory analysis.

For quality control purposes, a duplicate vapor sample should be collected from each sampling port. This sample is then put on hold at the laboratory pending initial analysis. To ensure quality control and minimize the potential for cross-contamination prior to and during sampling, the diaphragm pump is thoroughly purged for approximately 5 minutes with nitrogen or clean air (i.e., compressed clean air). A "blank" sample of the discharged air is captured in a

as necessary with a large-diameter bit.

"Tedlar" bag at the end of the purging procedure and may be analyzed to ensure the purging was effective.

To minimize the potential for cross-contamination between air samples, the polyethylene tubing, if not sample dedicated, is thoroughly cleaned and rinsed.

Vapor samples are subject to very limited holding times, typically 48 hours. Thus, care must be taken to avoid delays in submittal of vapor samples to the laboratory. In the event the vapor samples cannot be submitted to the analytical laboratory on the same day they are collected, they are to be temporarily stored in the dry, non-refrigerated, packed cooler until the very first opportunity for submittal well within the required holding time, taking into account the time needed for shipment to and receipt by the laboratory.

SOP-10

VAPOR SAMPLING: SYRINGE SAMPLING TECHNIQUE

Prior to vapor sampling, the vacuum system must reach a stabilized air flow (cubic feet per minute) for approximately 15 minutes. Prior to the actual collection of the vapor sample, the following data is recorded: air flow, temperature, and pressure at collection ports and gauges.

The sampling equipment consists of a clean, 100cc, gas-tight syringe and silicone septa.

The sampling ports are brass connections, fitted with silicone septa, and threaded into a tapped hole in the system piping. Samples are collected by inserting a clean syringe into the septum and the plunger actuated several times. Each syringe should be purged of three syringe volumes before collecting the sample. On the fourth purge, the plunger is extracted slowly until the syringe is filled with a gas sample, then the syringe is withdrawn and the needle immediately plugged with a silicone stopper. The sample should be placed in a non-refrigerated, dry cooler with sufficient packing to eliminate breakage during transport. Cooling samples will cause condensation of moisture, thereby distorting laboratory analysis.

For quality control purposes, a duplicate air sample should be collected from each port. This sample is put on hold at the laboratory pending initial analysis.

Vapor samples are subject to very limited holding times, typically 48 hours. Thus, care must be taken to avoid delays in submittal of vapor samples to the laboratory. In the event the vapor samples cannot be submitted to the analytical laboratory on the same day they are collected, they are to be temporarily stored in the dry, non-refrigerated, packed cooler until the very first opportunity for submittal well within the required holding time, taking into account the time needed for shipment to and receipt by the laboratory.

SOP-11

VAPOR SAMPLING: CANISTER SAMPLING TECHNIQUE

Prior to vapor sampling, the vacuum system must reach a stabilized air flow (cubic feet per minute) for approximately 15 minutes. Prior to the actual collection of the vapor sample, the following data is recorded: air flow, temperature, and pressure at collection ports and gauges.

The sampling equipment consists of a sterilized, gas-tight, "Vacu-Sampler" stainless steel canister, and 1/4-inch-diameter polyethylene tubing approximately 2 feet in length.

The sampling ports are brass connections fitted with silicone septa and threaded into a tapped hole in the system piping. The sampling procedure requires one end of the tubing to be slipped over the sampling port and the other end over the canister nozzle to acquire an air-tight connection. The actuator on top of the canister is depressed for 10 seconds. At the end of the 10 seconds, the canister is disconnected from the tubing and the tubing is

disconnected from the sampling port. Immediately following the sample collection, complete sampling information is recorded on the label on the air sampling canister (e.g., sample ID, date, time, location, and temperature). The sample is placed in a non-refrigerated, dry cooler with sufficient packing to ensure against For quality control purposes, a duplicate vapor sample should be collected from each sampling port. This sample is then put on hold at the laboratory pending the initial analysis. To minimize the potential for cross-contamination between vapor samples, the polyethylene tubing if not sample dedicated is thoroughly cleaned and rinsed.

damage during transport. Cooling samples will cause condensation of any moisture within the air sample, thereby distorting laboratory analysis.

Vapor samples are subject to very limited holding times, typically 48 hours. Thus, care must be taken to avoid delays in submittal of vapor samples to the laboratory. In the event the vapor samples cannot be submitted to the analytical laboratory on the same day they are collected, they are to be temporarily stored in the dry, non-refrigerated, packed cooler until the very first opportunity for submittal well within the required holding time, taking into account the time needed for shipment to and receipt by the laboratory.

SOP-12 MEASURING LIQUID LEVELS USING WATER LEVEL METER OR INTERFACE PROBE

Field equipment used for liquid-level gauging typically includes the measuring instrument (water-level meter or interface probe) and product bailer(s). The field kit also includes cleaning supplies (buckets, solution, spray bottles, and deionized water) to be used in cleaning the equipment between wells.

Prior to measurement, the instrument tip is lowered into the well until it touches bottom. Using the previously established top-of-casing or top-of-box (i.e., wellhead vault) point, the probe cord (or halyard) is marked and a measuring tape (graduated in hundredths of a foot) is used to determine the distance between the probe end and the marking on the cord. This measurement is then recorded on the liquid-level data sheet as the "Measured Total Depth" of the well.

When necessary in using the interface probe to measure liquid levels, the probe is first electrically grounded to either the metal stove pipe or another metal object nearby. When no ground is available, reproducible measurements can be obtained by clipping the ground lead to the handle of the interface probe case.

The probe tip is then lowered into the well and submerged in the groundwater. An oscillating (beeping) tone indicates the probe is in water. The probe is slowly raised until either the oscillating tone ceases or becomes a steady tone. In either case, this is the depth-to-water (DTW) indication and the DTW measurement is made accordingly. The steady tone indicates floating liquid hydrocarbons (FLH). In this case, the probe is slowly raised until the steady tone ceases. This is the depth-to-product (DTP) indication and the DTP measurement is made accordingly.

The process of lowering and raising the probe must be repeated several times to ensure accurate measurements. The DTW and DTP measurements are recorded on the liquid-level data sheet. When FLH are indicated by the probe's response, a product bailer is lowered partially through the FLH-water interface to confirm the FLH on the water surface and as further indication of the FLH thickness, particularly in cases where the FLH layer is quite thin. This measurement is recorded on the data sheet as "FLH thickness."

In order to avoid cross-contamination of wells during the liquid-level measurement process, wells are measured in the order of "clean" to "dirty" (where such information is available). In addition, all measurement equipment is cleaned with solution and thoroughly rinsed with deionized water before use between measurements in respective wells, and at the completion of the day's use.